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10/506,531	09/03/2004	Yoshikazu Ugai	033318-013	8951

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EXAMINER
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EWALD, MARIA VERONICA

ART UNIT	PAPER NUMBER
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1722

MAIL DATE	DELIVERY MODE
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05/11/2007

PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

# Office Action Summary

Application No.

10/506,531

Applicant(s)

UGAI ET AL.

Examiner

Maria Veronica D. Ewald

Art Unit

1722

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

## Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

- 1) ☒ Responsive to communication(s) filed on 19 April 2007.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

## Disposition of Claims

- 4) ☒ Claim(s) 1-12 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-6 and 9-12 is/are rejected.
- 7) ☒ Claim(s) 7-8 is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

## Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 03 September 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

## Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some \* c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.

## Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO/SB/08)  
Paper No(s)/Mail Date \_\_\_\_\_
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application
- 6) ☒ Other: Translation of JP 2002-105505

## DETAILED ACTION

### *Allowable Subject Matter*

13. Claims 7 – 8 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. Prior art fails to teach, either alone or in combination, a grasping member which engages with said base frame, wherein said grasping member fits slidably in the extending direction of said cavity and said lid member is forced against said die and held in position via a locking mechanism between said base frame and said grasping member; wherein said grasping member is divided into two portions in its sliding direction.

### *Claim Rejections - 35 USC § 103*

14. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1 – 6 are rejected under 35 U.S.C. 103(a) as being unpatentable over JP 2002-105505 in view of Hirabayashi (U.S. 6,355,210). JP 2002-105505 teaches a permanent magnet molding apparatus which is characterized by comprising: a mounting base (item 22 – figure 1); a transferable metal die unit transferable onto and off said mounting base (item 11 – figure 1; paragraph 0017), the die unit including: a die having

Art Unit: 1722

a cavity of desired cross-sectional shape in which filled, the cavity extending in groovelike form in a specific direction on a surface of the die (item S – figures 1, 3 – 4); a lid member placed against a facing surface of said die as if covering said cavity (item 16 – figure 3); and a pair of punches having the same cross-sectional shape as said cavity, said punches being positioned to fit in said cavity such that said punches close said cavity at both ends thereof, and said punches being made slidable in directions in which said punches go into contact with and become separated from the magnet molding material powder (items 13 and 14 – figures 3 and 4); pressurizing means for holding the metal die unit which has been transferred to said mounting base, with said magnet molding material powder filled in said cavity and for pressurizing said magnet molding material powder by driving said two punches such that said two punches slide in their approaching directions (paragraphs 0017 and 0021); wherein the metal die unit has a gap of 0.01 to 0.1 mm in part of said facing surface (figure 3); wherein said metal die unit has a base frame on which said die is located and said pair of punches has pushing parts at one end which are pressed by said pressurizing means and caused while being guided along the extending direction of said slide on said base frame cavity (figure 3); wherein said pressurizing means is a pair of cylinders situated along the extending direction of said cavity, wherein pistons of said cylinders extend face to face with end surfaces of the pushing parts of said punches to push said pushing parts, causing said punches to slide in their mutually approaching directions (figures 3 and 4; paragraphs 0021 and 0022).

The reference JP 2002-105505, however is silent with respect to the use of a magnetic field for compacting the powder. Use of a magnetic field is known to one of ordinary skill in the art and can be configured with the compaction apparatus above. For example, in a method to effectively compact powder, Hirabayashi teaches the use of a die in which two opposing punches are slidable in the extending direction to compress powder placed in the die cavity (figure 22). Hirabayashi further describes several embodiments, one in which compaction takes place via pressurizing cylinders alone and other embodiments in which a magnetic field is generated to provide compaction in addition to the use of punches or pressurizing cylinders (column 9, lines 1 – 15, 40 – 45). The magnetic field is generated via a magnetic coil situated through an upper lid where an opening of the die (item 2 – figure 3) is located. In an alternative configuration, the magnetic field is generated by a pair of yokes (item 81 – figure 22), onto which magnetic coils are wound (column 24, lines 1 – 10). This suggests Applicant's configuration such that there is magnetic field generating means, said said magnetic field generating means includes a pair of yokes located on an upper surface of the lid member and on a bottom surface of the die of said metal die unit and a coil wound around at least one of said yokes, wherein said yokes are movable in directions along said facing surface of the lid member and the die of said metal die unit, wherein the pair of yokes are attracted by each other and sandwich said lid member and said die to press against said facing surface when said coil is actuated.

Thus, it would have been obvious to one of ordinary skill in the art to modify the apparatus of JP 2002-105505, such that magnetic field generating means are placed on

Art Unit: 1722

the molding apparatus for the purpose of effectively compacting the powder placed in the cavity of the die.

Claims 9 – 12 are rejected under 35 U.S.C. 103(a) as being unpatentable over JP 2002-105505 in view of Hirabayashi and further in view of Maekawa, et al. (U.S. 3,663,147). JP 2002-105505 and Hirabayashi teach the characteristics previously described, but do not teach that the pushing parts have rollers.

In a method to produce tablets via compression molding, Maekawa, et al. teaches the use of a rotary press mold with upper and lower punches. The press mold utilizes a series of rollers attached to the punches themselves and guided on tracking rails (column 2, lines 55 – 58). The compression rollers are used to compress and exert pressure on the punch members as the tablets are formed (items 61 – 64 – figures 6 and 7). The use of the compression rollers allows for high velocity compression and short compression time, thus, resulting in increased production (column 1, lines 34 – 36). This reads on the Applicant's claims that the pushing parts have rotatably mounted rollers, wherein the pressurizing means has first guiding surfaces for guiding said rollers and second guiding surfaces formed immediately adjacent to the respective first guiding surfaces, wherein the distance between the said second guiding surfaces is smaller than the distance between said first guiding surfaces and said second guiding surfaces pressed against said rollers, causing said punches to slide in their mutually approaching directions.

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the Applicant's invention to modify the apparatus of JP 2002-105505, configured with the magnetic field generating means of Hirabayashi, further configured with the rollers and tracking rails of Maekawa, et al. for the purpose of causing the punches to move towards one another, thereby, compressing the powder, while such rollers allow high compression velocity and short dwell time, resulting in increased production, as taught by Maekawa, et al.

### ***Response to Arguments***

15. Applicant's arguments, see pages 3 – 5, filed April 19, 2007 with respect to the rejection(s) of claim(s) 1 – 8 under 102(b) have been fully considered and are persuasive. Therefore, the rejection has been withdrawn. However, upon further consideration, a new ground(s) of rejection is made in view of JP 2002-105505 and further in view of Hirabayashi.

With respect to the previous rejection of claims 1 – 8 as being anticipated by Sagawa, et al. (U.S. 5,762,967), Applicant argued that Sagawa, et al. did not teach punches positioned to fit in the die cavity. Examiner agrees and thus, the finality of the previous office action has been withdrawn; however, a new grounds of rejection is made with respect to JP 2002-105505 in view of Hirabayashi. JP 2002-105505 teaches a die unit transferable to a support unit used during molding. The die unit is then moved from the support unit subsequent to molding for removal of the compacted powder. The primary reference does not teach the use of a magnetic field; however, this is known to

Art Unit: 1722

one of ordinary skill in the art. Hirabayashi teaches several embodiments for compacting powder, using both pressurizing means and pressurizing means with a magnetic field.

With respect to dependent claims 7 – 8, none of the prior art references cited teach the use of a grasping member which engages the base frame and thus, claims 7 – 8 have been indicated as having allowable subject matter.

### ***Conclusion***

16. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Maria Veronica D. Ewald whose telephone number is 571-272-8519. The examiner can normally be reached on M-F, 8 - 4:30.


If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Dr. Yogendra Gupta can be reached on 571-272-1316. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.



Art Unit: 1722

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

MVE

  
ROBERT DAVIS  
PRIMARY EXAMINER  
GROUP 4300 1722

5/9/07

# TRANSLATION OF JP 2002-105505

## \* NOTICES \*

JPO and INPIT are not responsible for any damages caused by the use of this translation.

1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. \*\*\*\* shows the word which can not be translated.
3. In the drawings, any words are not translated.

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## DETAILED DESCRIPTION

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### [Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the molding approach of the particulate matter which carries out pressurization molding of the molding raw material which consists of particulate matters with which particulate matter restoration space was filled up, such as a metal and ceramics, and acquires a molding object, and molding equipment. the mixture of the thing which serves as a particulate matter only from grain with a bigger path than very fine fine particles or these fine particles or these fine particles, and grain -- saying -- obtaining -- \*\* The molding object acquired by pressurization molding serves as a sintered alloy article, a pottery article, etc. through a baking process etc.

[0002]

[Description of the Prior Art] Having been indicated by JP, 11-90913, A occurs as molding equipment for carrying out pressurization formation of the particulate matter conventionally. Four disengageable division frame part material 6, 6, 7, and 7 for frame types for assembling frame type 2 which forms the particulate matter restoration space S inside, as this molding equipment 1 is shown in drawing 6 and drawing 7, The molds 3 and 4 of the upper and lower sides which can be arranged so that the particulate matter restoration space S may be covered from the upper and lower sides, It has press means 8 and 8 for frame types to press the predetermined division frame part material 6 and 6 for frame types toward this particulate matter restoration space S, and press means 9 and 9 for vertical molds to press the molds 3 and 4 of these upper and lower sides [ into the particulate matter restoration space S ].

[0003] The molding approach using this molding equipment 1 like the frame type erector who assembles frame type 2 by the division frame part material 6, 6, 7, and 7 for these frames types While making the molding process which pressurizes and casts the restoration object P which consists of a particulate matter with which it filled up like the packer filled up with a particulate matter by the up-and-down molds 3 and 4 to the particulate matter restoration space S inside frame type 2, and the up-and-down molds 3 and 4 desert It consists of an unmolding process which separates the division frame part material 6, 6, 7, and 7 of frame type 2, and acquires the molding object G. He is trying to make an airtight condition join the adjoining division frame part material 6 and adjoining 7 like a frame type erector by forcing the division frame part material 6 and 6 for frame types with the press means 8 and 8 for frame types.

[0004]

[Problem(s) to be Solved by the Invention] Although he is trying to miss to the exterior at

said molding process with the air which coexists with a particulate matter to the particulate matter restoration space S from between up-and-down mold 3 and 4 and frame type 2 to the pressurization of the up-and-down molds 3 and 4, air may be made to remain in the acquired molding object G, without the ability fully missing. When the dimension of the vertical direction (Z shaft orientations) of the molding object G is large especially, the residual of the air in the main approach of the molding object G is remarkable. However, the air which remains in the molding object G expands at the time of unmolding, and a molding object may be damaged or it may become the cause of expanding at the time of baking of a back process, and making a burned product producing a crack.

[0005] Moreover, the welding pressure which joins the restoration object P in the middle of molding is only the thrust of Z shaft orientations added from the up-and-down molds 3 and 4, and reaction force force of X and Y shaft orientations in which it is added from frame type 2. The pressurization stress of the triaxial (X, Y, Z) direction generated on the restoration object P is equal in the state of a fluid good powder, or is in an almost equal condition. By the way, there are some from which it is firmly closed by the whole, an elastic property is discovered with advance of pressurization, the stress added from frame type 2 becomes small compared with the stress added from the up-and-down molds 3 and 4, and the pressurization stress of the triaxial (X, Y, Z) direction becomes uneven in the restoration object P. However, the pressurization stress of the triaxial direction may become the cause of making a burned product producing a crack in the case of [ at the time of baking of a back process ], with the molding object acquired in the uneven condition.

[0006] in order that [ then, ] this invention may solve the above-mentioned problem -- restoration -- it aims at offer of the molding approach of the particulate matter which can fully miss the air included inside of the body and molding equipment, and the molding equipment of the particulate matter which can make the pressurization stress of the triaxial direction approximate to a list as much as possible if needed.

[0007]

[Means for Solving the Problem] restoration -- the means which this invention according to claim 1 adopted in order [ which can fully miss the air included inside of the body ] it is alike and to carry out Like the frame type erector who assembles a frame type by two or more disengageable division frame part material for frame types In the molding approach of the particulate matter equipped with the molding process like the packer filled up with a particulate matter to the particulate matter restoration space of the this frame type inside which pressurizes and casts the particulate matter with which it filled up by the up-and-down mold said molding process The pre-pressurization process performed where the clearance for air escapes is formed between said adjoining division frame part material for frame types, It is the molding approach of the particulate matter characterized by making the post-pressurization process higher than a pre-pressurization process for the pressure which is equipped with the post-pressurization process performed in the condition of having stopped this clearance after this pre-pressurization process, or having made it small, and pressurizes said particulate matter.

[0008] If it is in this invention, the air included in the pre-pressurization process with the particulate matter with which it filled up In connection with pressurizing and compressing with an up-and-down mold, can fully discharge to the mold exterior from

the clearance for air escapes currently formed between the adjoining division frame part material for frame types, and it sets at a post-pressurization process. Pressurization molding can be carried out without making the particulate matter under pressurization escape from between the division frame part material for frame types which adjoins by pressurizing with high pressure from a pre-pressurization process in the condition of having stopped the gap between the adjoining division frame part material for frame types, or having made it small.

[0009] restoration -- \*\* of the air included inside of the body is the molding approach of the particulate matter according to claim 1 performed after the means which this invention according to claim 2 adopted in order to carry out for the ability doing early has formed the 2nd clearance for air escapes for \*\* between certain, and the mold of said upper and lower sides with which said pre-pressurization process is advancing to said particulate matter restoration space and a frame type.

[0010] If it is in this invention, since the air included in the pre-pressurization process with the particulate matter with which it filled up can be discharged to the exterior also from the 2nd clearance for air escapes formed between the up-and-down mold and the frame type, \*\* of air can carry out \*\* certainly and early.

[0011] restoration -- the means which this invention according to claim 3 adopted in order to be fully able to miss the air included inside of the body and to enable it to make the pressurization stress of the triaxial direction approximate as much as possible if needed further Two or more disengageable division frame part material for frame types for assembling the frame type which forms particulate matter restoration space inside, The mold of the upper and lower sides which can be arranged so that this particulate matter restoration space may be covered from the upper and lower sides, and a press means for frame types to press this division frame part material for frame types toward this particulate matter restoration space, In the molding equipment of the particulate matter equipped with a press means for vertical molds to press both these both [ one side or ] of a mold [ into particulate matter restoration space ] said press means for frame types In case the mold of said upper and lower sides is pressed with said press means for vertical molds, said division frame part material for frame types It is molding equipment of the particulate matter characterized by making it make it move forward toward said particulate matter restoration space to the post-pressurization location which stops this gap from the pre-pressurization location which forms the clearance for air escapes between the adjoining division frame part material for frame types, or is made small. In order to enable it to apply to various kinds of molding conditions, said division frame part material for frame types is made for said press means for frame types to be able to advance continuously from said pre-pressurization location to said post-pressurization location, or intermittently.

[0012] If it is in this invention, it can be filled up with a particulate matter to the particulate matter restoration space of the frame type inside assembled by two or more division frame part material for frame types, and it can be pressurized and cast by the mold of the upper and lower sides of the particulate matter with which it filled up to it. By forming the clearance for air escapes between the division frame part material for frame types which a pre-pressurization location is made to stop the division frame part material for frame types, and adjoins, the air included with the particulate matter with which it filled up is pressurized, and it can fully discharge from this clearance to the

exterior in the first half of this pressurization molding. Moreover, pressurization molding can be carried out, without making the particulate matter under pressurization flow out of between the adjoining division frame part material for frame types, even if it pressurizes with high pressure from the first half by changing into the condition stopped the gap between the division frame part material for frame types which is made to move forward and stop the division frame part material for frame types to a post-pressurization location, and adjoins in the second half of this pressurization molding, or made it small.

Furthermore, it becomes possible to make the pressurization stress of the triaxial direction which produces it on the restoration object under pressurization molding in particulate matter restoration space since the perimeter of the restoration object under pressurization molding can be pressurized by the division frame part material for frame types which moves forward to a post-pressurization location toward particulate matter restoration space approximate as much as possible in the second half of this pressurization molding.

[0013] The means which this invention according to claim 4 adopted in order to be able to perform easily modification of the halt location of the division frame part material for frame types Said press means for frame types the output shaft and actuation shaft which were installed from the both ends of the piston made inner fitting of the attitude of free to the fixed cylinder body The oil hydraulic cylinder which is made to project from this cylinder body and pressed said division frame part material for frame types with this output shaft, By having the halt implement which adjusts the halt location of this output shaft in contact with this cylinder body, while screwing in this actuation shaft on the outside of this cylinder body, and rotating this halt implement It is molding equipment of a particulate matter according to claim 3 which enabled it to move forward said division frame part material for frame types pressed with this output shaft from said pre-pressurization location to said post-pressurization location. In addition, in order to make rotation actuation of a halt implement easy, it may be made to carry out the rotation drive of the gearing for original \*\* which engraves the gearing for a follower on the periphery of a halt implement and which both meshes with this gearing for a follower with a servo motor.

[0014] If it is in this invention, it is carrying out rotation accommodation of the halt implement, and the predetermined division frame part material for frame types can be moved forward from a pre-pressurization location to a post-pressurization location. Furthermore, the welding pressure to the predetermined division frame part material for frame types can be adjusted by adjusting the pressure of the oil supplied to an oil hydraulic cylinder.

[0015]

[Embodiment of the Invention] Hereafter, the molding approach of a particulate matter and molding equipment concerning this invention are explained based on the gestalt of operation shown in a drawing.

[0016] Drawing 1 thru/or drawing 4 are what shows the gestalt of operation of the molding approach concerning this invention, and molding equipment. The top view which drawing 1 omits a part of molding equipment, and is shown, the transverse-plane sectional view which drawing 2 expands the important section of the molding equipment under molding, and is shown, The front view showing the supporting structure in the condition that drawing 3 holds the unified mold for molding temporarily which carried

out the partial cross section, Drawing 4 shows the frame type in the condition of having assembled, the mold for molding in the condition that (A) separated the top view and (B) separated a transverse-plane sectional view and drawing 5 is shown, (A) is a top view and (B) is a transverse-plane sectional view. In addition, in the following explanation, the "right" points out the right-hand side of drawing 1 , drawing 2 , drawing 3 , drawing 4 (A), and drawing 5 (A), and points out the left-hand side of these Figs. [ "left" ] Moreover, a "front" points out the drawing 1 , drawing 4 (A), and drawing 5 (A) bottom, and the "back" points out these Fig. bottom. Furthermore, a "top" points out the drawing 2 , drawing 4 (B), and drawing 5 (B) bottom, and the "bottom" points out these Fig. bottom.

[0017] The molding equipment 10 concerning the gestalt of this operation has the mold 11 for molding assembled, the supporting structure 22 which hold the mold 11 for molding temporarily since it is filled up with a particulate matter, a transport device 23 for conveying the mold 11 for molding with which it filled up with the particulate matter from the supporting structure 22 to the molding location of press equipment 21, and press equipment 21 which press for pressurization molding of the mold 11 for molding with which it filled up with the particulate matter.

[0018] Said mold 11 for molding is frame type 12 which forms in the inside the particulate matter restoration space S which extends [ vertically ] as [ assemble / in the condition of having had the wrap punch 13 and female mold 14, and having been laid in \*\*\*\* 15 / the upper and lower sides of the particulate matter restoration space S ], as shown in drawing 3 thru/or drawing 5 . Frame type 12 is assembled from four disengageable division frame part material 16, 16, 17, and 17, and is decomposed. \*\*\*\* 15 is fabricated by four division frame part material 16, 16, 17, and 17 and the up-and-down mold 13, and 14 lists from metal materials, such as steel. Through tube 15a can be drilled in a center section, and this \*\*\*\* 15 can make now the output shaft 43 (refer to drawing 2 ) of the press implement 26 for female mold which presses female mold 14 penetrate. A step is formed in the lower part, and female mold 14 fits this step into this through tube 15 in the state of clearance BAME, and can be positioned now. When pressing with the press equipment 21 which mentions the mold 11 for molding later, it changes into a clearance BAME condition for female mold 14 enabling it to move to a predetermined pressurization location.

[0019] The division frame part material 16, 16, 17, and 17 which constitutes said type 11 for molding of frame type 12 enables it to have moved between the molding location (to refer to drawing 4 ) which the adjoining division frame part material 16 and adjoining 17 contact, and forms the particulate matter restoration space S, and the unmolding locations (to refer to drawing 5 ) which dissociate and retreat from the particulate matter restoration space S, as shown in drawing 4 and drawing 5 . The frame part material \*\*\*\* implements 18 and 18 required for a frame type assembly are really formed in order both-ends approach at each division frame part material 16. the condition that the frame part material \*\*\*\* implements 18 and 18 before and behind one division frame part material 16 and the frame part material \*\*\*\* implements 18 and 18 before and behind the division frame part material 16 of another side countered -- a longitudinal direction (X shaft orientations) -- estrangement and approach -- it can do -- coming -- \*\*\*\* -- between the division frame part material 17 and 17 -- 4 sets -- it brings near and devices 19 and 19 and -- are formed.

[0020] said -- it brought near, and devices 19 and 19 and each of -- are equipped with advance guidance device 19a and halt device 19b as shown in drawing 4 . Advance guidance device 19a is equipped with the inclined planes 17a and 18a which extend in the vertical direction (Z shaft orientations) established in each of the division frame part material 17 and the frame part material \*\*\*\* implement 18. When moving the division frame part material 17 to a molding location (refer to drawing 4 ) from an unmolding location (refer to drawing 5 ), it enables it to carry out the sliding contact of inclined plane 17a and the 18a, while making inclined planes 17a and 18a incline so that it may meet in the direction which intersects a longitudinal direction (X shaft orientations). As for theta, 45 degrees is adopted whenever [ to the X-axis of inclined planes 17a and 18a / tilt-angle ]. It enables it to stop the division frame part material 17 by equipping halt device 19b with the halt sides 17b and 18b which extend to the vertical direction (Z shaft orientations) and longitudinal direction (X shaft orientations) which were prepared in each of the division frame part material 17 and the frame part material \*\*\*\* implement 18, and making halt side 17b and 18b contact (refer to drawing 4 ).

[0021] The press equipment 21 pressed for pressurization molding of said mold 11 for molding is equipped with press means 25 and 25 for frame types to press the division frame part material 16 and 16 for frame types toward the particulate matter restoration space S, and press means 26 and 26 (refer to drawing 2 ) for vertical molds press the up-and-down molds 13 and 14 [ into the particulate matter restoration space S ] as shown in drawing 1 and drawing 2 . In case the press means 25 and 25 for frame types press the up-and-down molds 13 and 14 with the press means 26 and 26 for vertical molds It is the 1st clearance ( ) for air escapes between the division frame part material 17 and 17 for frame types which adjoins the division frame part material 16 and 16 for frame types. That is, it constitutes so that it may be made to move forward continuously or intermittently toward the particulate matter restoration space S to the post-pressurization location which stops this gap from the pre-pressurization location which forms the gap formed so that it may penetrate in the vertical direction among the halt sides 17b and 18b shown in drawing 4 , or is made small. In case the 1st clearance for air escapes pressurizes the particulate matter with which the particulate matter restoration space S is filled up with the up-and-down molds 13 and 14, it is for missing to the exterior the air which coexists with a particulate matter to the particulate matter restoration space S. The thickness dimension of the 1st clearance for air escapes is set as a proper value according to the specification of the particulate matter with which it fills up in the particulate matter restoration space S.

[0022] Each of said press means 25 and 25 for frame types is equipped with the oil hydraulic cylinder 27, the halt implement 28, and the measurement implement 29. An oil hydraulic cylinder 27 is equipped with the cylinder body 31 fixed to the base 38, the piston 32 made inner fitting of the attitude of free to the cylinder body 31, and the output shaft 33 and the actuation shaft 34 which installs from the both ends of a piston 32 and projects from the cylinder body 27, and has pressed the division frame part material 16 for frame types toward the particulate matter restoration space S with the press plate 35 attached at the tip of an output shaft 33.

[0023] By forming this halt implement 28 from the female screw screwed in the male screw formed in the actuation shaft 34 which projects on the outside of the cylinder body 31, and adjusting the halt location of an output shaft 33 in contact with the cylinder body

31 It enables it to have chosen the halt location of the division frame part material 16 for frame types between said pre-pressurization location (location which forms said 1st clearance for air escapes), and said post-pressurization location (location which stops said 1st gap for air escapes, or is made small). The halt implement 28 is driven with the rotation driving gear 36 (refer to drawing 1 ), and can be made to carry out adjustable [ of the halt location of an output shaft 33 ]. The rotation driving gear 36 consists of gearing 36b for original \*\* which gears with gearing 36a for a follower engraved on the periphery of the halt implement 28, and gearing 36a for a follower, and servo motor 36c which consists of a stepping motor which drives gearing 36b for original \*\*, and it enables it to have chosen the halt location of an output shaft 33 by controlling servo motor 36c. The measurement implement 29 is for measuring the location of the output shaft 33 which moves. the deflection of the current position of the output shaft 33 with which the measurement implement 29 measured the control circuit of servo motor 36c, and the set-up the pre-pressurization location or post-pressurization location which is a halt location -- losing -- or -- small -- \*\* -- like, it may constitute so that feedback control may be carried out

[0024] Each of press means 26 and 26 for vertical molds to constitute said press equipment 21 is equipped with the oil hydraulic cylinder 39 and the measurement implement 40 as shown in drawing 2 . An oil hydraulic cylinder 39 is equipped with the cylinder body 41 fixed to the base 38, the piston 42 made inner fitting of the attitude of free to the cylinder body 41, and the output shaft 43 and the shaft 44 for measurement which installs from the both ends of a piston 42 and projects from the cylinder body 41, and has pressed the vertical molds 13 and 14 which correspond at the tip of an output shaft 33 [ into the particulate matter restoration space S ]. In addition, the downward press means 26 for female mold may be omitted, and it may constitute so that it may pressurize only with the upper press means 26 for punches.

[0025] Said press equipment 21 is equipped with the control unit (illustration abbreviation) for setting up the pressure value (namely, output value of each oil hydraulic cylinders 27 and 39) of the hydraulic oil supplied to each oil hydraulic cylinders 27 and 39 while it outputs a seizing signal and a stop signal to said press means 25 and 25 for frame types, and said press means 26 and 26 for vertical molds. The circuitry of this control unit has carried out so that the timing made to approach to the post-pressurization location which stops this gap from the pre-pressurization location which forms the 1st clearance for air escapes for the timing which the vertical molds 13 and 14 which are the adjustment matters at the time of molding are made to approach, and 2 sets of frame part material \*\*\*\* implements 18 and 18 with which the division frame part material 16 and 16 for frame types counters, or is made small may adjust in time. Moreover, if the vertical molds 13 and 14 which are the adjustment matters at the time of unmolding are made to desert, the circuitry of this control unit has been carried out so that timing and the timing which makes 2 sets of frame part material \*\*\*\* implements 18 and 18 with which the division frame part material 16 and 16 for frame types counters desert can be adjusted in time. Furthermore, the circuitry of this control unit has been carried out so that the pressure value of the oil supplied to each oil hydraulic cylinders 27 and 39 can be changed into the optimum value beforehand set up according to each timing. In addition, this control unit classifies into plurality the between from the pre-pressurization location to which 2 sets of frame part material \*\*\*\* implements 18 and 18 are moved to a post-



pressurization location, and may be able to be made to perform said adjustment in every partition.

[0026] As said supporting structure 22 held temporarily shows the assembled mold 11 for molding to drawing 1 and drawing 3 , it has the press maintenance means 48 and 48 of the right and left for carrying out press maintenance of the division frame part material 16 and 16 for frame types of right and left of the mold [ finishing / assembly ] 11 for molding which was guided at the guides 47 and 47 for \*\*\*\* mentioned later, and has stopped in the maintenance location M. Each of the press maintenance means 48 and 48 consists of a pneumatic cylinder which fixed cylinder body 48a to the base 38, and has attached press maintenance plate 48c at the tip of output-shaft 48b which can move freely. The press maintenance means 48 and 48 cancel this press maintenance, when output shafts 48b and 48b advance, press maintenance of the division frame part material 16 and 16 for frame types is carried out and output shafts 48b and 48b retreat conversely.

[0027] It changes temporary assembly \*\*\*\* carrying in beforehand into the condition that it is shown in drawing 5 , or the molds 11 for molding before holding by said supporting structure 22 are temporary assembly \*\*\*\* in the location of the supporting structure 22.

This temporary assembly is performed by a help or assembly equipment (illustration abbreviation). The mold 11 for temporary assembly \*\*\*\* molding is pressed as approached in the division frame part material 16 for frame types, and 16 with the output shafts 48b and 48b with which the press maintenance means 48 and 48 advance, and it is assembled by the condition of having connected with the division frame part material 17 and 17 for frame types, and having unified as shown in drawing 4 . The assembled mold 11 for molding is in a condition [ being held by the supporting structure 22 ], and restoration of a particulate matter and insertion of a punch 13 of [ in the particulate matter restoration space S ] are performed. Insertion of a punch 13 is automatically performed by hand control or the robot for punch insertion (illustration abbreviation).

[0028] It is equipped with the conveyance means 46 which consists of a pneumatic cylinder which backs up \*\*\*\* 15, making it guide the guides 47 and 47 for \*\*\*\* on either side installed to the cross direction, and the guide 47 for \*\*\*\* on either side, as are shown in drawing 1 and drawing 3 , and the transport device 23 which conveys the mold 11 for molding from the maintenance location M of said supporting structure 22 to the molding location K of said press equipment 21 guides \*\*\*\* 15 to the molding location K.

[0029] Next, the molding approach of the particulate matter concerning this invention is explained based on the gestalt of the operation using said mold 11 for molding. The molding approach concerning the gestalt of this operation like the frame type erector who assembles frame type 12 as surrounds female mold 14 by four division frame part material 16, 16, 17, and 17 for frame types which can be joined and separated Like the packer filled up with a particulate matter to the particulate matter restoration space S inside frame type 12 The punch insertion process which inserts a punch 13 in upper limit opening of frame type 12, and assembles the mold for molding, The conveyance process conveyed to the location of the molding process which mentions this assembled mold 11 for molding later, While making the molding process which casts by making the up-and-down molds 13 and 14 approach by pressurizing a particulate matter, and the up-and-down molds 13 and 14 desert, pressing frame type 12 so that the division frame part material 16, 16, 17, and 17 for frame types may not be made to separate It is made to perform the unmolding process which unmolds by canceling the press to frame type 12

and separating the division frame part material 16, 16, 17, and 17 for frame types in order of this process.

[0030] While making the lower part step of the female mold 14 laid on \*\*\*\* 15 insert in through tube 15a as shown in drawing 5, four groups bring near and it enables it to form a device 19 like said frame type erector by surrounding female mold 14 by four division frame part material 16, 16, 17, and 17 for frame types laid on \*\*\*\* 15. The thing of this condition is carried in to the supporting structure 22, it presses so that the division frame part material 16 and 16 for frame types may be made to approach with the press means 48 and 48 of the supporting structure 22, and as shown in drawing 4, the mold 11 for molding is assembled.

[0031] As said packer shows drawing 3 at a punch insertion process, a particulate matter is filled up into the particulate matter restoration space S inside frame type 12 with the condition of having held by the supporting structure 22 so that frame type 12 of the mold 11 for molding may not decompose, and a punch 13 is inserted in upper limit opening of the particulate matter restoration space S after that. By being pressed with the press implement (illustration abbreviation) which consists of a pneumatic cylinder of the robot for punch insertion etc., the inserted punch 13 presses a particulate matter and hardens it moderately. In case extent of this pressurization is conveyed at the following conveyance process, the hardened particulate matter makes it extent which does not carry out mold collapse.

[0032] At said conveyance process, as shown in drawing 1, it is back conveyed with the conveyance means 23, making the mold 11 (illustrated by the two-dot chain line in drawing) for molding of which maintenance by the supporting structure 22 was canceled guide in the guides 47 and 47 for \*\*\*\* with \*\*\*\* 15, and the shaping location K of press equipment 21 is stopped. Stoppers 50 and 50 are formed in the shaping location K side, and the predetermined molding location K can be made to stop \*\*\*\* 15.

[0033] Said molding process consists of a pre-pressurization process of the first half, and a post-pressurization process of the second half. The pre-pressurization process of the first half performs, where the 1st clearance for air escapes is formed in frame type 12 of the mold 11 for molding. The 1st clearance for air escapes is formed so that it may extend in the vertical direction among the halt sides 17b and 18b of the adjoining division frame part material 16 and 17 for frame types. Although the thickness dimension (distance from halt side 17b to 18b) of this clearance for air escapes changes with specifications of the particulate matter with which it fills up in the particulate matter restoration space S, it is set up in 0.01mm thru/or 0.05mm. In order to obtain the clearance for air escapes between this set-up dimension value, the halt implements 28 and 28 of the press means 25 and 25 for frame types are adjusted, and the pre-pressurization location where the 1st set-up clearance for air escapes is obtained is made to stop the division frame part material 16 and 16 for frame types.

[0034] The adjoining division frame part material 16 for frame types and adjoining 17 may stick frame type 12 of the mold 11 for molding conveyed in the molding location K, and it may be in the condition that there is no 1st clearance for air escapes. However, if the particulate matter in the particulate matter restoration space S is compressed by the pressurization of the molds 13 and 14 of the upper and lower sides by the press means 26 and 26 for vertical molds, it will be pressed in the direction which it moves [ direction ] to X and Y shaft orientations, and retreats the division frame part material 16, 16, 17, and

17 for frame types. The pressed division frame part material 16, 16, 17, and 17 for frame types retreats to the pre-pressurization location which contacts press means 25 and 25 for frame types by which the halt location was adjusted, and it stops and it forms the 1st set-up clearance for air escapes. The mold 11 for molding forms the 2nd clearance for air escapes also between frame type 12 and the up-and-down molds 13 and 14 by retreat halt of the division frame part material 16, 16, 17, and 17 for frame types.

[0035] In the pre-pressurization process of the first half, the air which coexists with a particulate matter in the particulate matter restoration space S will be compressed if the pressurization of the molds 13 and 14 of the upper and lower sides by the press means 26 and 26 for vertical molds advances, it passes through said 1st clearance for air escapes, and said 2nd clearance for air escapes, and is discharged in the exterior of the mold 11 for molding. The air which exists in the main approach of the particulate matter restoration space S distant from this 2nd clearance for air escapes will pass through the 1st clearance for air escapes between nearby, will be discharged outside, and can fully perform degassing compared with the conventional molding approach without the 1st clearance for air escapes. As a value of the welding pressure of the molds 13 and 14 of the upper and lower sides in this pre-pressurization process, it is 50 - 150 kg/cm<sup>2</sup>, for example. It is chosen.

[0036] When the pre-pressurization process of the first half is completed and it shifts to the post-pressurization process of the second half While increasing gradually the welding pressure of the molds 13 and 14 of the upper and lower sides by the press means 26 and 26 for vertical molds By increasing gradually the welding pressure of the press means 25 and 25 for frame types, adjusting the halt implements 33 and 33 of the press means 25 and 25 for frame types The division frame part material 16 and 16 for frame types stopped in the pre-pressurization location which forms the 1st clearance for air escapes is advanced toward the particulate matter restoration space S with the division frame part material 17 and 17 for frame types. The 1st clearance for air escapes currently formed in frame type 12 is gradually made small, and a closedown or the post-pressurization location made small is made to stop the 1st clearance for air escapes. The 2nd clearance for air escapes currently formed between frame type 12 and the up-and-down molds 13 and 14 also becomes small gradually with advance of the division frame part material 16, 16, 17, and 17 for frame types of this frame type 12.

[0037] The timing which increase gradually the welding pressure of the press means 26 and 26 for vertical molds, and the vertical molds 13 and 14 are made to approach, With the timing which increases gradually the welding pressure of the press means 25 and 25 for frame types, and advances the division frame part material 16 and 16 for frame types, and 17 and 17 while adjusting the halt implements 33 and 33 of the press means 25 and 25 for frame types It is set up according to molding conditions, such as a property of a particulate matter, and welding pressure, and is automatically controlled by the press means 26 and 26 for vertical molds and the press means 25 and 25 for frame types which the control signal emitted from said control unit was received. In addition, advance of the division frame part material 16 and 16 for frame types by the press means 25 and 25 for frame types is performed continuously or intermittently according to molding conditions, and the optimal pressurization molding is obtained. As a value of the molds 13 and 14 of the upper and lower sides [ in / after this / a pressurization process ], and the welding pressure of the division frame part material 16, 16, 17, and 17 for frame types, it is 150 -

1250 kg/cm<sup>2</sup>, for example. It is chosen.

[0038] In this post-pressurization process of the second half, pressurization molding can be carried out with high pressure, without making the particulate matter under pressurization flow out of the 1st and 2nd gaps for air escapes into the exterior, even if it pressurizes with high pressure from the pre-pressurization process of the first half by changing into the condition of having stopped said 1st and 2nd gaps for air escapes, or having made it small. Furthermore, it becomes that it is possible to make the pressurization stress of the triaxial direction which produces on the restoration object P which it is firmly closed by the post-pressurization process of the second half by the whole while being pressurization molding since the perimeter of the restoration object P under pressurization molding can be pressurized by the division frame part material 16, 16, 17, and 17 for frame types which moves forward to a post-pressurization location toward the particulate matter restoration space S, and came to discover an elastic property approximate as much as possible.

[0039] If the post-pressurization process of the second half is completed, it will shift to an unmolding process. At an unmolding process, while making the vertical molds 13 and 14 desert, decreasing gradually the welding pressure of the press means 26 and 26 for vertical molds, the division frame part material 16, 16, 17, and 17 for frame types is retreated decreasing gradually the welding pressure of the press means 25 and 25 for frame types, the mold 11 for molding is disassembled after that, and a molding object is acquired. The timing which makes the vertical molds 13 and 14 desert, and the timing which retreats the division frame part material 16, 16, 17, and 17 for frame types are automatically controlled by the press means 26 and 26 for vertical molds and the press means 25 and 25 for frame types receive the control signal emitted from said control unit to decrease the pressurization stress of the triaxial direction produced on the molding object in the condition made it approximate as much as possible.

[0040] In order to pick out a molding object from the mold 11 for molding in an unmolding process, ejection is performed in the location which was retreated by the transport device 23 and retreated to the molding location K and the location of the supporting structure 22. Hand control or automatic are made to perform this ejection.

[0041] Said mold 11 for molding is brought near between the adjoining division frame part material 16 and 17 for frame types, forms a device 19, and has pressed the frame 12 with 2 sets of press means 25 and 25 for frame types while it forms the frame part material \*\*\*\* implements 18 and 18 before and after each division frame part material 16 for frame types. However, although the mold for molding in this invention is not limited to this at all and illustration was omitted, it is also possible to constitute so that each of the division frame part material for frame types which constitutes a frame type may be pressed with the press means 25 for frame types.

[0042] In order to control the halt location of molds 13 and 14, the press means 26 and 26 for vertical molds for pressing the molds 13 and 14 of said upper and lower sides are forming the halt implement 28 (referring to drawing 1 ) in this actuation shaft while changing the shaft 44 for measurement of an oil hydraulic cylinder 39 into an actuation shaft, and may be constituted like said press means 25 for frame types. When making a predetermined location suspend the up-and-down molds 13 and 14, a molding object with a fixed vertical height dimension value can be acquired. Furthermore, while fixing weight of the particulate matter with which the particulate matter restoration space S is filled up,

the high molding object of dimensional accuracy cast by fixed welding pressure can be acquired by making the molds 13 and 14 of the upper and lower sides in a post-pressurization process, and the halt location of the division frame part material 16, 16, 17, and 17 for frame types into a predetermined location.

[0043] Furthermore, although they are not limited to this at all although said press means 25 for frame types and the press means 26 for vertical molds are made to pressurize with oil pressure using an oil hydraulic cylinder, and illustration was omitted, it is carrying out the rotation drive of the nut screwed in the output shaft which consists of a bolt with an electric motor, and it is also possible to change into the steel jack structure of making an output shaft moving. In this case, the halt location of the division frame part material 16, 16, 17, and 17 for frame types or the up-and-down molds 13 and 14 is controllable by adjusting the rotational frequency of an electric motor and operating the halt location of an output shaft.

[0044]

[Effect of the Invention] the molding approach of the particulate matter concerning this invention according to claim 1 -- a pre-pressurization process -- setting -- restoration -- since pressurization molding of the restoration object can be carried out with high pressure in a post-pressurization process after fully discharging air in the living body to the exterior from the clearance for air escapes between the division frame part material for frame types, a molding object without residual air can be acquired and improvement in the yield of a molding object can be aimed at.

[0045] since the molding approach of the particulate matter concerning this invention according to claim 2 can discharge air also from the 2nd clearance for air escapes to the exterior -- restoration -- \*\* of the air included inside of the body can acquire the molding object of certain and the high quality which is made early and does not have residual air for \*\*.

[0046] The molding equipment of the particulate matter concerning this invention according to claim 3 In the first half of pressurization molding, the clearance for air escapes is formed between the division frame part material for frame types. restoration -- air in the living body can fully be discharged from this gap to the exterior, the molding object which does not have residual air in the clearance for air escapes in the second half of pressurization molding a closedown or by making it small and carrying out pressurization molding of the restoration object with high pressure can be acquired, and improvement in the yield of a molding object can be aimed at. Furthermore, since it becomes possible to make the pressurization stress of the triaxial direction produced on the restoration object under pressurization molding approximate as much as possible, the molding object which a crack cannot produce easily at the time of baking of a back process can be acquired.

[0047] Since the molding equipment of the particulate matter concerning this invention according to claim 4 can perform easily modification of the halt location of the division frame part material for frame types, or welding pressure, it can aim at improvement in production efficiency.

**\* NOTICES \***

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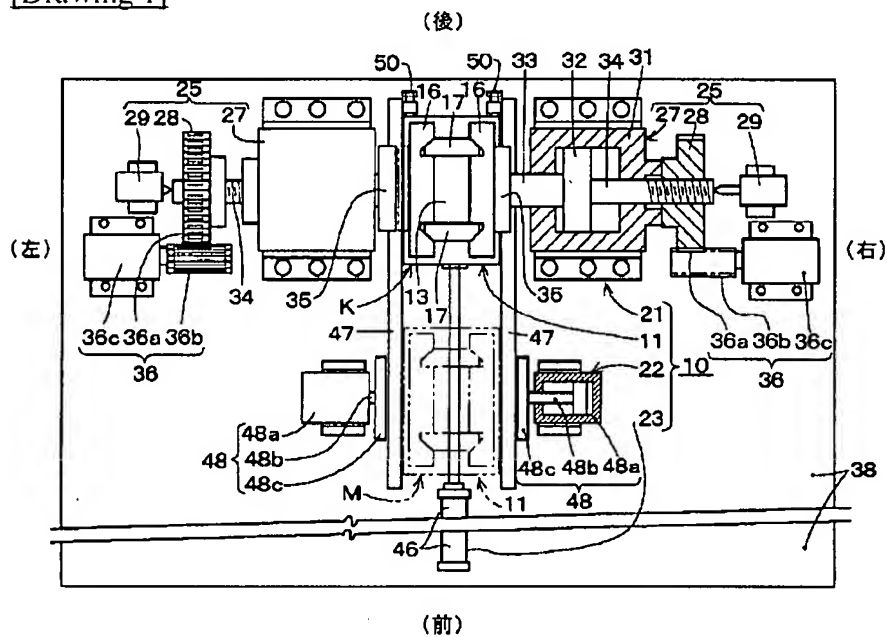
1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. \*\*\*\* shows the word which can not be translated.
3. In the drawings, any words are not translated.

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**DRAWINGS**

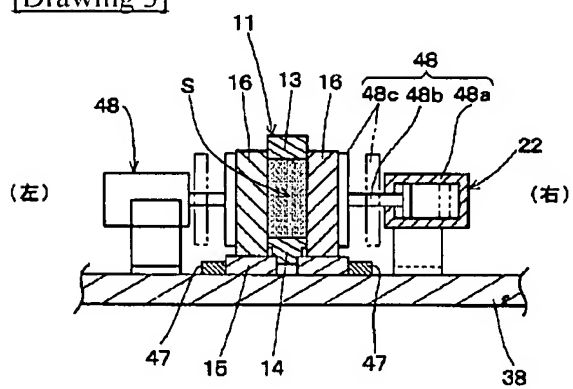
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[Drawing 1]



[Drawing 2]

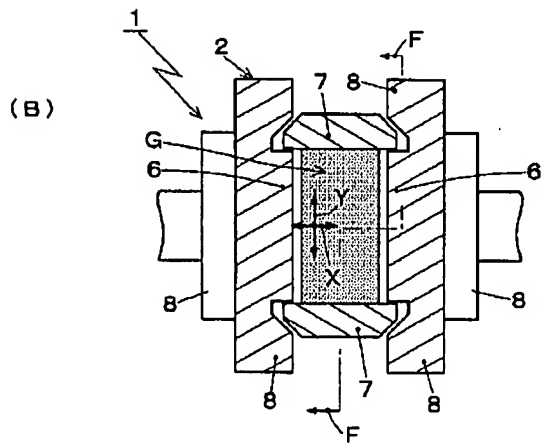
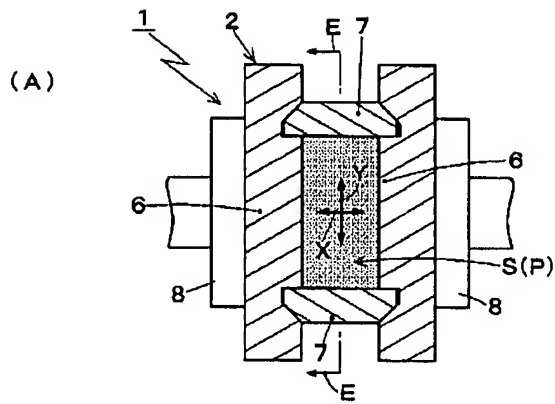
[Drawing 3]



[Drawing 4]







[Drawing 7]

